Generator Modification and Repair History
Revision 7 - July 15, 2008

Summary

Capital Project IGS03-05 was originally developed to insure continued reliable operation of the Intermountain generators. Work under this project included replacing obsolete excitation systems on both units, and rewinding the Unit 1 generator field to repair a turn-to-turn short . During the field rewind we also completed a General Electric recommended inspection and machining of the field forging (TIL 1292).

We are currently in the process of purchasing a spare stator winding (CEP07-03) and preparing to rewind both generator stator windings. Unit 2 is tentatively scheduled to be rewound in April 2010 and Unit 1 is scheduled to be rewound in April 2011. Because the outage time required to rewind the generators is at least five to six weeks, this work is being coordinated with a project to replace the low pressure turbine buckets. We are currently finalizing the schedules for both projects to determine outage time requirements. During the Unit 2 generator rewind, we are also planning on completing the TIL 1292 inspection of the field forging.

Repair and Modification Work Sequence

We originally started investigating and planning for repair and modification of the IGS generators because of an industry wide problem with water leaks in generators manufactured by General Electric. Purchase of a spare stator winding was scheduled based on General Electric recommendations and continuing problems with the hydraulic integrity of the winding. However, epoxy repairs performed in 1996 on Unit 2 and 1997 on Unit 1 fixed many of the initial leaks and slowed the formation of new leaks. In addition, outage testing of the stator windings indicated this problem was progressing slowly. Therefore, replacing the excitation systems became a higher then purchasing a spare stator winding.

In addition, the Unit 1 generator field developed a turn-to-turn short circuit in the Spring of 2005. This short circuit limited the reactive capability of the generator due to vibration caused by thermal sensitivity of the field rotor.

The money originally allocated to purchase spare stator bars was used to rewind the Unit 1 field in April 2007. A separate capital purchase, CEP 07-03, was created to purchase a spare stator winding in 2008.

Based on increasing degradation of the generator stator windings, shown by electrical testing, continuing winding leaks, shown by hydraulic integrity testing (HIT) testing and SLMS, and winding looseness we are planning on performing full stator rewinds in 2010 and 2011.

The following modifications and repairs have been completed.

Replaced Unit 2 Excitation System	Spring 2006
Replaced Unit 1Excitation System	Spring 2007
Rewound Unit 1 Field	Spring 2007
Performed Unit 1 TIL 1292 Field Inspection	Spring 2007

The current schedule for generator modifications is:

Receive Spare Stator Winding	Spring 2009
Rewind Unit 2 Generator Stator Winding	Spring 2010
Perform Unit 2 TIL 1292 Field Inspection	Spring 2010
Rewind Unit 1 Generator Stator Winding	Spring 2011

Project History

The generator excitation system replacement and spare stator winding project, IGS03-05, was developed to maintain the reliability of the generators.

The original project budget included:

System studies and specification preparation	2003 - 2004	$ 85,000
Purchase and install Unit 1 excitation system	2004 - 2005	$3,760,000
Purchase and install Unit 2 excitation system and purchase spare stator winding	2005 - 2006	$7,560,000

The revised budget included:

Unit 1 Excitation System	2006-2007	$3,000,000*
Unit 1 Field Rewind	2006-2007	$2,000,000
Spare Stator Winding	2007-2008	$5,000,000

* includes $2,000,000 carried over from the 2005-2006 because of late equipment deliveries

The current ten year plan includes:

Unit 2 Stator Rewind	2009-2010	$7,000,000
Unit 1 Stator Rewind	2010-2011	$2,000,000

The following items are being added:

Unit 2 Field Inspection	2009-2010	$ 750,000
Partial set of spare bars	2010-2011	$1,000,000

We are currently reviewing proposals from Alstom and General Electric for rewinding the generators and providing spare stator bars. In addition, we are currently anticipating a small project, less than $150,000, to modify the bus work associated with the Unit 2 excitation system to reduce outage time associated with potential bus failures and generator maintenance.

We started reviewing the performance of the generator stator windings based on a TIL from General Electric in 1991. Early on we determined we had a significant problem with the hydraulic integrity of the stator windings. Global epoxy repairs of the windings in 1996 (Unit 2) and 1997 (Unit 1) significantly improved the winding integrity, but we continue to have problems passing the GE recommended vacuum and pressure tests on both stator windings.

After we started evaluating the reliability of the generators, it became apparent that within a few years we would need to replace the excitation systems on both units. General Electric informed us they were no longer manufacturing the Generrex excitation systems and this equipment was now obsolete. GE was still providing parts on a best effort basis however they were unable to supply replacement bridge disconnect switches and field current transducers because of component obsolescence. We had ongoing problems with drifting field current transducers, misaligned DC field circuit breakers and intermittent connections on the bridge disconnects for both units. In addition, we had intermittent control power supply grounds on the trip circuit bus on Unit 2. In addition, experienced technical support became difficult to find.

General Electric originally sold less than 30 compound source Generrex systems. Through discussions with other Generrex owners, it was apparent that continued reliable operation of these exciters was not feasible. After our evaluation we decided to post pone the purchase of the spare stator bars until after the Unit 2 exciter was replaced.

We worked with GE and other vendors, starting in 2001, to determine the best approach for replacing our excitation system. Our system is somewhat unique because the dome, which houses the major magnetic components, is welded to the generator frame. For years GE recommended removing the dome so the magnetic components, also located in the dome, could be removed. This process was both time consuming and risky. In April 2005, GE determined that the components in the dome could be removed by disassembling and taking them out through the openings for the hydrogen coolers. Finally, in late 2005, GE agreed that there was a way to simply modify the components in the dome instead of removing them.

As part of the evaluation of the excitation system replacement , GE was awarded a contract to compare the electrical characteristics of a new bus fed excitation system with the current Generrex excitation system. This study was completed in June 2004 and revised in July 2004. The new bus fed system would not provide the same response as the original Generrex system. The focal point of the study was comparing critical clearing time (CCT) for faults. Both in the study and in the meeting to review the study, GE recognized there are other characteristics of excitation systems which affect system stability and reliability. Because of delays in the system studies and the development of an acceptable work scope for the dome work, the excitation

system replacement was delayed for one year.

A detailed specification was prepared for the new excitation systems and the work was scheduled for Unit 2 in April 2006 and Unit 1 in April 2007. General Electric was awarded the contract to perform this work.

The Unit 2 excitation system was replaced in March and April 2006. The new exciter and excitation transformer were installed in March 2006. During the April 2006 outage, connections to the existing controls and interfaces were completed, the dome equipment was modified and testing was completed. Unit 1 was completed in April 2007.

Both Unit 1 and 2 excitation system are now online and functioning correctly. We have completed PSS (power system stabilizer) testing to validate the PSS settings.

In 2005, a new concern was identified for long term reliable operation of the generators. Testing after the Unit 1 Spring 2005 outage indicated the field had developed a turn-to-turn short. This short was apparently causing thermal sensitivities in the field. The turn-to-turn short was discovered due to generator vibrations at varying field current conditions and was confirmed through flux probe testing. Plans were then made to rewind the Unit 1 field in 2007. In order to minimize impact of the cost the rewind to the capital budget the generator stator bar purchase was postponed.

At the start of the Unit 2 Spring 2006 Outage additional flux probe testing was performed on both units. The test on Unit 1 indicated there might not be a turn-to-turn short in the field. In the Fall of 2006, an independent consultant, GeneratorTech confirmed the presence of the turn-to-turn short. Based on these results the Unit 1 field was rewound in 2007.

Because of continued winding leaks, indicated by the stator leak monitoring systems and HIT skid testing we currently plan on rewinding both generators to insure continued reliable operation. In addition, the stator winding support system has loosen and needs to be replaced.

IGS 03-05 Generator Excitation System Replacements and Spare Stator Winding
Revision 4 - July 19, 2006

Summary

Capital Project IGS03-05 was originally developed to insure continued reliable operation of the generators. The original scope of the project included purchasing a spare stator winding and replacing the exciters for both units.

The spare stator winding was scheduled for purchase first because of recommendations from General Electric and continuing problems with the hydraulic integrity of the winding. However, because epoxy repairs fixed many of the initial leaks and biannual testing of the stator windings indicated this problem was progressing slowly, the replacement of the exciters was moved up in the schedule. The exciters became a higher priority because of the lack of replacement parts and technical support for the existing systems.

In addition, we are currently evaluating rewinding the Unit 1 Generator field because of a suspected turn-to-turn short. Depending on the results of the investigation into the Unit 1 field winding , we are planning to purchase a field insulation kit and rewind the field or start purchasing spare stator bars.

The current schedule for generator modifications is:

Complete tuning of new Unit 2 excitation system	Spring 2006
Replace Unit 1 excitation system	Spring 2007 Outage
Rewind the Unit 1 field or purchase field insulation kit	Spring 2007 Outage
Purchase of spare stator winding (multi-year)	July 2006 - June 2008

Project History

The generator excitation system replacement and spare stator winding project, IGS03-05, was developed to maintain the reliability of the generators.

The original project budget included:

System studies and specification preparation	2003 - 2004	$ 85,000
Purchase and install Unit 1 excitation system	2004 - 2005	$3,760,000
Purchase and install Unit 2 excitation system and purchase spare stator winding	2005 - 2006	$7,560,000

We started reviewing the performance of the generator stator windings based, on a TIL (technical information letter) from General Electric in 1991. Early on, we determined we had a significant

problem with the hydraulic integrity of the stator windings. Global epoxy repairs of the windings in 1996 (Unit 2) and 1997 (Unit 1) significantly improved the winding integrity, but we continue to have problems passing the GE recommended vacuum and pressure tests on the stator winding.

After we started evaluating the reliability of the generators it became apparent that within a few years we would need to replace the excitation systems on both units. The current generator excitation system is no longer manufactured by General Electric (GE). GE is still providing parts, as the components are available from their suppliers, and there is limited field support personnel with Generrex experience. Recently, GE was unable to supply replacement bridge disconnect switches and field current transducers because of component obsolescence. We have had ongoing problems with drifting field current transducers, misaligned DC field circuit breakers and intermittent connections on the bridge disconnects for both units. In addition, we have had intermittent control power supply grounds on the trip circuit bus on Unit 2. We currently stock critical spare parts for most of the Generrex controls, but we do not have any spare parts for the components in the generator dome.

There are less than 30 compound source Generrex systems in service and through discussions with other Generrex owners, it is apparent that continued reliable operation of these units is not feasible. After our evaluation we decided to delay the purchase of the spare stator bars until after the Unit 2 exciter was replaced.

We have been working with GE and other vendors, since 2001, to determine the best approach for replacing our excitation system. Our system is somewhat unique because the dome, which houses the major magnetic components, is welded to the generator frame. For years, GE has recommended removing the dome so the magnetic components, located in the dome, can be removed. This process is both time consuming and risky. In April 2005, GE determined that the components in the dome could be removed by disassembling and removing them through the openings for the hydrogen coolers. Finally, in late 2005, GE agreed that there was a way to simply modify the components in the dome instead of removing them.

As part of the excitation system replacement evaluation, GE was awarded a contract to compare the electrical characteristics of a new bus fed excitation system with the current Generrex excitation system. This study was completed in June 2004 and revised in July 2004. The new bus fed system does not provide the same response as the original Generrex system. The focal point of the study was comparing critical clearing time (CCT) for faults. Both in the study and in the meeting to review the study, GE recognized there are other characteristics of excitation systems which affect system stability and reliability. Because of delays in the system studies and the development of an acceptable work scope for the dome work, the excitation replacement was delayed for one year.

A detailed specification was prepared for the new excitation systems and the work was scheduled for Unit 2 April 2006 and Unit 1 April 2007. General Electric was awarded the contract to perform this work.

The Unit 2 excitation system was replaced in March and April 2006. The new exciter and excitation transformer were installed in March 2006. During the April 2006 outage, connections to the existing controls and interfaces were completed, the dome equipment was modified and testing was completed.

The Unit 2 excitation system is now online and functioning correctly. We recently completed PSS (power system stabilizer) testing to validate the PSS settings. A report on the system is being prepared by GE for submittal to LADWP and the WECC. Over the next few months we will continue to optimize the system.

In 2005 a new concern was identified for long term reliable operation of the generators. Testing after the Unit 1 Spring 2005 outage indicated the field had developed a turn-to-turn short. This short was apparently causing thermal sensitivities in the field. The turn-to-turn short was discovered due to generator vibrations at varying field current conditions and was confirmed through flux probe testing. Plans were then made to rewind the Unit 1 field in 2007. In order to minimize impact to the capital budget, caused by the cost of rewinding the field the stator bar purchase was postponed.

In 2006, at the start of the Unit 2 outage, additional flux probe testing was performed on both units. The most recent test on Unit 1 indicates there may not be a turn-to-turn short in the field. We are currently working on a testing program to resolve the questions about the condition of the Unit 1 field. Part of the testing program included hiring an independent consultant to perform additional flux probe testing.

Depending on the results of this testing, we may delay rewinding the Unit 1 generator field. If this project is delayed, we will use the capital project funds to purchase a field re wind insulation kit and start purchasing spare stator bars.

Generator Modification and Repair History
Revision 6 - November 17, 2006

Summary

Capital Project IGS03-05 was originally developed to insure continued reliable operation of the Intermountain generators. The original scope of the project included purchasing a spare stator winding and replacing the exciters for both units.

The spare stator winding was scheduled for purchase first because of recommendations from General Electric and continuing problems with the hydraulic integrity of the winding. However, because epoxy repairs fixed many of the initial leaks and biannual testing of the stator windings indicated this problem was progressing slowly, the replacement of the exciters was moved up in the schedule. The exciters became a higher priority because of the lack of replacement parts and technical support for the existing systems.

In addition, the Unit 1 generator field developed a turn-to-turn short circuit in the Spring of 2005. This short circuited limited the reactive capability of the generator due to vibration caused by thermal sensitivity of the field rotor.

The money originally allocated to purchase spare stator bars was used to rewind the Unit 1 field in April 2007. A separate capital purchase, CEP 07-03, was created to purchase a spare stator winding in 2008.

Based on increasing degradation of the generator stator windings, shown by electrical testing, continuing winding leaks, shown by hydraulic integrity testing (HIT) testing and SLMS, and winding looseness we are planning on performing full stator rewinds in 2010 and 2011.

The following modifications and repairs have been completed.

Replaced Unit 2 Excitation System	Spring 2006
Replaced Unit 1Excitation System	Spring 2007
Rewound Unit 1 Field	Spring 2007

The current schedule for generator modifications is:

Purchase spare stator winding	Fall 2008
Rewind Unit 2 Generator Stator Winding	Spring 2010
Rewind Unit 1 Generator Stator Winding	Spring 2011

Project History

The generator excitation system replacement and spare stator winding project, IGS03-05, was

developed to maintain the reliability of the generators.

The original project budget included:

System studies and specification preparation	2003 - 2004	$ 85,000
Purchase and install Unit 1 excitation system	2004 - 2005	$3,760,000
Purchase and install Unit 2 excitation system and purchase spare stator winding	2005 - 2006	$7,560,000

The revised budget included:

Unit 1 Excitation System	2006-2007	$3,000,000*
Unit 1 Field Rewind	2006-2007	$2,000,000
Spare Stator Winding	2007-2008	$5,000,000

* includes $2,000,000 carried over from the 2005-2006 because of late equipment deliveries

The ten year plan includes:

Unit 2 Stator Rewind	2009-2010	$7,000,000
Unit 1 Stator Rewind	2010-2011	$2,000,000*

We are currently working with stator winding suppliers to determine their recommendations for spare bars. The project cost will increase based on the need to stock at least some spare winding material. In addition, we are currently anticipating a small project, less than $150,000, to modify the bus work associated with the Unit 2 excitation system to reduce outage time associated with bus failures and to reduce outage time associated with the generator maintenance.

We started reviewing the performance of the generator stator windings based, on a TIL (technical information letter) from General Electric in 1991. Early on, we determined we had a significant problem with the hydraulic integrity of the stator windings. Global epoxy repairs of the windings in 1996 (Unit 2) and 1997 (Unit 1) significantly improved the winding integrity, but we continue to have problems passing the GE recommended vacuum and pressure tests on the stator winding.

After we started evaluating the reliability of the generators it became apparent that within a few years we would need to replace the excitation systems on both units. The current generator excitation system is no longer manufactured by General Electric (GE). GE is still providing parts, as the components are available from their suppliers, and there is limited field support personnel with Generrex experience. Recently, GE was unable to supply replacement bridge disconnect switches and field current transducers because of component obsolescence. We have had ongoing problems with drifting field current transducers, misaligned DC field circuit breakers and intermittent connections on the bridge disconnects for both units. In addition, we

have had intermittent control power supply grounds on the trip circuit bus on Unit 2. We currently stock critical spare parts for most of the Generrex controls, but we do not have any spare parts for the components in the generator dome.

There are less than 30 compound source Generrex systems in service and through discussions with other Generrex owners, it is apparent that continued reliable operation of these units is not feasible. After our evaluation we decided to delay the purchase of the spare stator bars until after the Unit 2 exciter was replaced.

We have been working with GE and other vendors, since 2001, to determine the best approach for replacing our excitation system. Our system is somewhat unique because the dome, which houses the major magnetic components, is welded to the generator frame. For years, GE has recommended removing the dome so the magnetic components, located in the dome, can be removed. This process is both time consuming and risky. In April 2005, GE determined that the components in the dome could be removed by disassembling and removing them through the openings for the hydrogen coolers. Finally, in late 2005, GE agreed that there was a way to simply modify the components in the dome instead of removing them.

As part of the excitation system replacement evaluation, GE was awarded a contract to compare the electrical characteristics of a new bus fed excitation system with the current Generrex excitation system. This study was completed in June 2004 and revised in July 2004. The new bus fed system does not provide the same response as the original Generrex system. The focal point of the study was comparing critical clearing time (CCT) for faults. Both in the study and in the meeting to review the study, GE recognized there are other characteristics of excitation systems which affect system stability and reliability. Because of delays in the system studies and the development of an acceptable work scope for the dome work, the excitation replacement was delayed for one year.

A detailed specification was prepared for the new excitation systems and the work was scheduled for Unit 2 April 2006 and Unit 1 April 2007. General Electric was awarded the contract to perform this work.

The Unit 2 excitation system was replaced in March and April 2006. The new exciter and excitation transformer were installed in March 2006. During the April 2006 outage, connections to the existing controls and interfaces were completed, the dome equipment was modified and testing was completed.

Both Unit 1 and 2 excitation system are now online and functioning correctly. We have completed PSS (power system stabilizer) testing to validate the PSS settings.

In 2005, a new concern was identified for long term reliable operation of the generators. Testing after the Unit 1 Spring 2005 outage indicated the field had developed a turn-to-turn short. This short was apparently causing thermal sensitivities in the field. The turn-to-turn short was

discovered due to generator vibrations at varying field current conditions and was confirmed through flux probe testing. Plans were then made to rewind the Unit 1 field in 2007. In order to minimize impact to the capital budget, caused by the cost of rewinding the field the stator bar purchase was postponed.

In 2006, at the start of the Unit 2 outage, additional flux probe testing was performed on both units. The Spring 2006 test on Unit 1 indicates there may not be a turn-to-turn short in the field. In the Fall of 2006, an independent consultant, GeneratorTech confirmed the presence of the turn-to-turn short. Based on these results the Unit 1 field was rewound in 2007.

Because of continued winding leaks, indicated by the stator leak monitoring systems and HIT skid testing we currently plan on rewinding both generators to insure continued reliable operation.

Generator Modification and Repair History
Revision 8 - April 15, 2009

Summary

Capital Project IGS03-05 was originally developed to insure continued reliable operation of the Intermountain generators. Work under this project included replacing obsolete excitation systems on both units, and rewinding the Unit 1 generator field to repair a turn-to-turn short . During the field rewind we also completed a General Electric recommended inspection and machining of the field forging (TIL 1292).

We are currently in the process of purchasing a spare stator winding (CEP07-03) and preparing to rewind both generator stator windings. Unit 2 is tentatively scheduled to be rewound in the fall of 2010 and Unit 1 is scheduled to be rewound in April 2011. Because the outage time required to rewind the generators is at least five to six weeks, this work is being coordinated with a project to replace the low pressure turbine buckets. The Unit 2 rewind has been moved to the fall to coordinate with the converter station controls upgrade. We are currently finalizing the start date and outage duration for this outage. During the Unit 2 generator rewind, we are also planning on completing the TIL 1292 remediation of the field forging.

Repair and Modification Work Sequence

We originally started investigating and planning for repair and modification of the IGS generators because of an industry wide problem with water leaks in generators manufactured by General Electric. Purchase of a spare stator winding was scheduled based on General Electric recommendations and continuing problems with the hydraulic integrity of the winding. However, epoxy repairs performed in 1996 on Unit 2 and 1997 on Unit 1 fixed many of the initial leaks and slowed the formation of new leaks. In addition, outage testing of the stator windings indicated this problem was progressing slowly. Therefore, replacing the excitation systems became a higher priority then purchasing a spare stator winding.

In addition, the Unit 1 generator field developed a turn-to-turn short circuit in the Spring of 2005. This short circuit limited the reactive capability of the generator due to vibration caused by thermal sensitivity of the field rotor.

The money originally allocated to purchase spare stator bars was used to rewind the Unit 1 field in April 2007. A separate capital purchase, CEP 07-03, was created to purchase a spare stator winding in 2008.

Based on increasing degradation of the generator stator windings, shown by electrical testing, continuing winding leaks, shown by hydraulic integrity testing (HIT) testing and SLMS, and winding looseness we are planning on performing full stator rewinds in 2010 and 2011.

The following modifications and repairs have been completed.

Replaced Unit 2 Excitation System	Spring 2006
Replaced Unit 1Excitation System	Spring 2007
Rewound Unit 1 Field	Spring 2007
Performed Unit 1 TIL 1292 Field Inspection	Spring 2007

The current schedule for generator modifications is:

Receive Spare Stator Winding	Spring 2009
Rewind Unit 2 Generator Stator Winding	Fall 2010
Perform Unit 2 TIL 1292 Field Inspection	Fall 2010
Rewind Unit 1 Generator Stator Winding	Spring 2011

Project History

The generator excitation system replacement and spare stator winding project, IGS03-05, was developed to maintain the reliability of the generators.

The original project budget included:

System studies and specification preparation	2003 - 2004	$ 85,000
Purchase and install Unit 1 excitation system	2004 - 2005	$3,760,000
Purchase and install Unit 2 excitation system and purchase spare stator winding	2005 - 2006	$7,560,000

The revised budget included:

Unit 1 Excitation System	2006-2007	$3,000,000*
Unit 1 Field Rewind	2006-2007	$2,000,000
Spare Stator Winding	2007-2008	$5,000,000

* includes $2,000,000 carried over from the 2005-2006 because of late equipment deliveries

The current projected cash flow for both rewinds including a partial set of spare bars is:

2008-2009	$4,027,770
2009-2010	$3,400,000
2010-2011	$7,500,000

This cash flow is based on the Unit 2 outage being moved to the Fall of 2010.
The following item is being added:

Unit 2 Field Inspection	2010-2011	$ 780,000

In addition, we are currently anticipating a small project, less than $150,000, to modify the bus work associated with the Unit 2 excitation system to reduce outage time associated with potential bus failures and generator maintenance.

We started reviewing the performance of the generator stator windings based on a TIL from General Electric in 1991. Early on we determined we had a significant problem with the hydraulic integrity of the stator windings. Global epoxy repairs of the windings in 1996 (Unit 2) and 1997 (Unit 1) significantly improved the winding integrity, but we continue to have problems passing the GE recommended vacuum and pressure tests on both stator windings.

After we started evaluating the reliability of the generators, it became apparent that within a few years we would need to replace the excitation systems on both units. General Electric informed us they were no longer manufacturing the Generrex excitation systems and this equipment was now obsolete. GE was still providing parts on a best effort basis however they were unable to supply replacement bridge disconnect switches and field current transducers because of component obsolescence. We had ongoing problems with drifting field current transducers, misaligned DC field circuit breakers and intermittent connections on the bridge disconnects for both units. In addition, we had intermittent control power supply grounds on the trip circuit bus on Unit 2. Also, experienced technical support became difficult to find.

General Electric originally sold less than 30 compound source Generrex systems. Through discussions with other Generrex owners, it was apparent that continued reliable operation of these exciters was not feasible. After our evaluation we decided to post pone the purchase of the spare stator bars until after the Unit 2 exciter was replaced.

We worked with GE and other vendors, starting in 2001, to determine the best approach for replacing our excitation system. Our system is somewhat unique because the dome, which houses the major magnetic components, is welded to the generator frame. For years GE recommended removing the dome so the magnetic components, also located in the dome, could be removed. This process was both time consuming and risky. In April 2005, GE determined that the components in the dome could be removed by disassembling and taking them out through the openings for the hydrogen coolers. Finally, in late 2005, GE agreed that there was a way to simply modify the components in the dome instead of removing them.

As part of the evaluation of the excitation system replacement , GE was awarded a contract to compare the electrical characteristics of a new bus fed excitation system with the current Generrex excitation system. This study was completed in June 2004 and revised in July 2004. The new bus fed system would not provide the same response as the original Generrex system. The focal point of the study was comparing critical clearing time (CCT) for faults. Both in the study and in the meeting to review the study, GE recognized there are other characteristics of excitation systems which affect system stability and reliability. Because of delays in the system studies and the development of an acceptable work scope for the dome work, the excitation system replacement was delayed for one year.

A detailed specification was prepared for the new excitation systems and the work was scheduled for Unit 2 in April 2006 and Unit 1 in April 2007. General Electric was awarded the contract to perform this work.

The Unit 2 excitation system was replaced in March and April 2006. The new exciter and excitation transformer were installed in March 2006. During the April 2006 outage, connections to the existing controls and interfaces were completed, the dome equipment was modified and testing was completed. Unit 1 was completed in April 2007.

Both Unit 1 and 2 excitation systems are now online and functioning correctly. We have completed PSS (power system stabilizer) testing to validate the PSS settings.

In 2005, a new concern was identified for long term reliable operation of the generators. Testing after the Unit 1 Spring 2005 outage indicated the field had developed a turn-to-turn short. This short was apparently causing thermal sensitivities in the field. The turn-to-turn short was discovered due to generator vibrations at varying field current conditions and was confirmed through flux probe testing. Plans were then made to rewind the Unit 1 field in 2007. In order to minimize impact of the cost the rewind to the capital budget the generator stator bar purchase was postponed.

At the start of the Unit 2 Spring 2006 Outage additional flux probe testing was performed on both units. The test on Unit 1 indicated there might not be a turn-to-turn short in the field. In the Fall of 2006, an independent consultant, GeneratorTech confirmed the presence of the turn-to-turn short. Based on these results the Unit 1 field was rewound in 2007.

Because of continued winding leaks, indicated by the stator leak monitoring systems and HIT skid testing we currently plan on rewinding both generators to insure continued reliable operation. In addition, the stator winding support system has loosen and needs to be replaced. A contract with General Electric was signed in January 2009 to provide the stator bars and rewind both Unit 1 and Unit 2.

IGS 03-05 Generator Excitation System Replacements and Spare Stator Winding
Revision 1 - April 24, 2005

Summary

Capital Project IGS03-05 includes replacing the excitation system for both generators and purchasing a spare stator winding which can be used on either generator. The original schedule for this project is shown below:

System studies and specification preparation	2003 - 2004
Purchase and install Unit 1 excitation system	Spring 2005 Outage
Purchase and install Unit 2 excitation system	Spring 2006 Outage
Purchase spare stator winding	June 2006

We recommend delaying the purchase and installation of the new excitation system, for Unit 1, until the Spring 2007 Outage. This will allow more time to :

1. Finalize new equipment locations and finalize the routing of control cables, power cables and bus.

2. Resolve concerns on disassembling the magnetic components in the dome. We will be able to use the 2005 outage to evaluate General Electric's (GE's) recent proposal to disassemble the components in place instead of removing the generator dome.

3. Perform final electrical studies to determine critical excitation system characteristics.

4. Evaluate other utilities experience with a Generrex replacement to determine best practices and actual time requirements.

The Unit 2 equipment will still be installed in 2006. There is limited risk in delaying the installation of the new system for Unit 1. Both excitation systems are currently working correctly.

Project History

The generator excitation system replacement and spare stator winding project was developed to increase the reliability of the generators. The current generator excitation system, Generrex is no longer manufactured by General Electric (GE). GE is still providing parts, as the components are available from their suppliers, and there is limited field support personnel with Generrex experience. Recently, GE has been unable to supply replacement bridge disconnect switches and field current transducers because of component obsolescence. We currently stock critical spare

parts for most of the Generrex controls, but we do not have any spare parts for the components in the generator dome.

The original project budget included:

System studies and specification preparation	2003 - 2004	$ 85,000
Purchase and install Unit 1 excitation system	2004 - 2005	$3,760,000
Purchase and install Unit 2 excitation system and purchase spare stator winding	2005 - 2006	$7,560,000

Several utilities have planned for Generrex replacements in the next few years but until recently none of the systems had been replaced. GE replaced the first Generrex excitation system in the Fall of 2004 at the Coronado Generating Station. Alstom is scheduled to replace their first Generrex system in May 2005. GE has two more replacements scheduled in late 2005 and early 2006.

We have been working with GE and other vendors, since 2001, to determine the best approach for replacing our excitation system. Our system is somewhat unique because the dome, that houses the major magnetic components, is welded to the generator frame. For years, GE has recommended removing the dome so the magnetic components can be removed. This process is both time consuming and risky. In April 2005, GE determined that the components in the dome could be removed by disassembling and removing them through the openings for the hydrogen coolers. GE is still working out the details for this procedure and they have indicated they will provide final details with their bid. We should review their procedure, during a unit outage to verify there is adequate space within the dome to safely disassemble the components and remove them though a hydrogen cooler opening.

As part of the excitation system replacement, GE was required to provide a comparison of the electrical characteristics of a new bus fed excitation system with the current Generrex excitation system. This study was completed in June and revised in July 2004. The new bus fed system does not provide the same response as the original Generrex system. The focal point of the study was comparing critical clearing time (CCT) for faults. Both in the study and in the meeting to review the study, GE recognized there are other characteristics of excitation systems which affect system stability and reliability. We still need to continue working with the LADWP studies group to determine the most critical performance characteristics of a new excitation system.

GE has been on site three times to assist with finalizing the location of the new excitation system equipment. We are currently evaluating our third choice for the installation of this equipment. The equipment requires significant floor space and has been difficult to locate and still allow room for installation and maintenance.

The transformer, which replaces the equipment mounted in the dome, has increased in size to 11 feet by 24 feet. The size changed after GE finalized details of the transformer design with the

transformer manufacturer. This requires placing the transformer on the turbine deck instead of the first floor. The location on the turbine deck will require a structural review and detailed routing of the large isolated phase bus conductors.

The original location for the excitation line up was in the same place as the existing system. This choice was abandoned early on because of outage time concerns and space requirements. The next choice was the 6900 volt switchgear room. Because the switchgear room provides a cleaner environment the design was based on a NEMA 1 enclosure. The NEMA 1 lineup requires 4 feet by 22 feet. Because of space concerns, in the switchgear room, the excitation system has been moved to the turbine deck . This has increased the size of the equipment to 8 feet by 30 feet to provide space for weather tight housing. This is a custom enclosure which GE is still finalizing with the manufacturer. This also requires significant modifications to control and power cable wiring and bus routing.

Generator Excitation Replacements, Unit 1 Field Rewind and Spare Stator Winding
Revision 5 - November 17, 2006

Summary

Capital Project IGS03-05 was originally developed to insure continued reliable operation of the generators. The original scope of the project included purchasing a spare stator winding and replacing the exciters for both units.

The spare stator winding was scheduled for purchase first because of recommendations from General Electric and continuing problems with the hydraulic integrity of the winding. However, because epoxy repairs fixed many of the initial leaks and biannual testing of the stator windings indicated this problem was progressing slowly, the replacement of the exciters was moved up in the schedule. The exciters became a higher priority because of the lack of replacement parts and technical support for the existing systems.

In addition in the Spring of 2005 the Unit 1 generator field developed a turn-to-turn short. This short limits the reactive capability of the generator due to vibration caused by thermal sensitivity of the field rotor.

The money originally allocated to purchase spare stator bars will be used to rewind the Unit 1 field. A separate capital purchase was submitted, for the 2007-2008 budget, to purchase the spare stator winding.

The current schedule for generator modifications is:

Complete tuning of new Unit 2 excitation system	Spring 2006
Replace Unit 1 excitation system	Spring 2007 Outage
Rewind the Unit 1 generator field	Spring 2007 Outage
Purchase of spare stator winding (multi-year)	July 2007 - June 2008

Project History

The generator excitation system replacement and spare stator winding project, IGS03-05, was developed to maintain the reliability of the generators.

The original project budget included:

System studies and specification preparation	2003 - 2004	$ 85,000
Purchase and install Unit 1 excitation system	2004 - 2005	$3,760,000
Purchase and install Unit 2 excitation system and purchase spare stator winding	2005 - 2006	$7,560,000

The revised budget includes:

Unit 1 Excitation System	2006-2007	$3,000,000*
Unit 1 Field Rewind	2006-2007	$2,000,000
Spare Stator Winding	2007-2008	$5,000,000

* includes $2,000,000 carried over from the 2005-2006 because of late equipment deliveries

We started reviewing the performance of the generator stator windings based, on a TIL (technical information letter) from General Electric in 1991. Early on, we determined we had a significant problem with the hydraulic integrity of the stator windings. Global epoxy repairs of the windings in 1996 (Unit 2) and 1997 (Unit 1) significantly improved the winding integrity, but we continue to have problems passing the GE recommended vacuum and pressure tests on the stator winding.

After we started evaluating the reliability of the generators it became apparent that within a few years we would need to replace the excitation systems on both units. The current generator excitation system is no longer manufactured by General Electric (GE). GE is still providing parts, as the components are available from their suppliers, and there is limited field support personnel with Generrex experience. Recently, GE was unable to supply replacement bridge disconnect switches and field current transducers because of component obsolescence. We have had ongoing problems with drifting field current transducers, misaligned DC field circuit breakers and intermittent connections on the bridge disconnects for both units. In addition, we have had intermittent control power supply grounds on the trip circuit bus on Unit 2. We currently stock critical spare parts for most of the Generrex controls, but we do not have any spare parts for the components in the generator dome.

There are less than 30 compound source Generrex systems in service and through discussions with other Generrex owners, it is apparent that continued reliable operation of these units is not feasible. After our evaluation we decided to delay the purchase of the spare stator bars until after the Unit 2 exciter was replaced.

We have been working with GE and other vendors, since 2001, to determine the best approach for replacing our excitation system. Our system is somewhat unique because the dome, which houses the major magnetic components, is welded to the generator frame. For years, GE has recommended removing the dome so the magnetic components, located in the dome, can be removed. This process is both time consuming and risky. In April 2005, GE determined that the components in the dome could be removed by disassembling and removing them through the openings for the hydrogen coolers. Finally, in late 2005, GE agreed that there was a way to simply modify the components in the dome instead of removing them.

As part of the excitation system replacement evaluation, GE was awarded a contract to compare the electrical characteristics of a new bus fed excitation system with the current Generrex

excitation system. This study was completed in June 2004 and revised in July 2004. The new bus fed system does not provide the same response as the original Generrex system. The focal point of the study was comparing critical clearing time (CCT) for faults. Both in the study and in the meeting to review the study, GE recognized there are other characteristics of excitation systems which affect system stability and reliability. Because of delays in the system studies and the development of an acceptable work scope for the dome work, the excitation replacement was delayed for one year.

A detailed specification was prepared for the new excitation systems and the work was scheduled for Unit 2 April 2006 and Unit 1 April 2007. General Electric was awarded the contract to perform this work.

The Unit 2 excitation system was replaced in March and April 2006. The new exciter and excitation transformer were installed in March 2006. During the April 2006 outage, connections to the existing controls and interfaces were completed, the dome equipment was modified and testing was completed.

The Unit 2 excitation system is now online and functioning correctly. We recently completed PSS (power system stabilizer) testing to validate the PSS settings. A report on the system is being prepared by GE for submittal to LADWP and the WECC. Over the next few months we will continue to optimize the system.

In 2005 a new concern was identified for long term reliable operation of the generators. Testing after the Unit 1 Spring 2005 outage indicated the field had developed a turn-to-turn short. This short was apparently causing thermal sensitivities in the field. The turn-to-turn short was discovered due to generator vibrations at varying field current conditions and was confirmed through flux probe testing. Plans were then made to rewind the Unit 1 field in 2007. In order to minimize impact to the capital budget, caused by the cost of rewinding the field the stator bar purchase was postponed.

In 2006, at the start of the Unit 2 outage, additional flux probe testing was performed on both units. The Spring 2006 test on Unit 1 indicates there may not be a turn-to-turn short in the field. In the Fall of 2006, an independent consultant, GeneratorTech confirmed the presence of the turn-to-turn short. Based on these results we plan to rewind the Unit field in the Spring 2007 Outage

IGS 03-05 Generator Excitation System Replacements and Spare Stator Winding
Revision 4 - July 19, 2006

Summary

Capital Project IGS03-05 was originally developed to insure continued reliable operation of the generators. The original scope of the project included purchasing a spare stator winding and replacing the exciters for both units.

The spare stator winding was scheduled for purchase first because of recommendations from General Electric and continuing problems with the hydraulic integrity of the winding. However, because epoxy repairs fixed many of the initial leaks and biannual testing of the stator windings indicated this problem was progressing slowly, the replacement of the exciters was moved up in the schedule. The exciters became a higher priority because of the lack of replacement parts and technical support for the existing systems.

In addition, we are currently evaluating rewinding the Unit 1 Generator field because of a suspected turn-to-turn short. Depending on the results of the investigation into the Unit 1 field winding , we are planning to purchase a field insulation kit and rewind the field or start purchasing spare stator bars.

The current schedule for generator modifications is:

Complete tuning of new Unit 2 excitation system	Spring 2006
Replace Unit 1 excitation system	Spring 2007 Outage
Rewind the Unit 1 field or purchase field insulation kit	Spring 2007 Outage
Purchase of spare stator winding (multi-year)	July 2006 - June 2008

Project History

The generator excitation system replacement and spare stator winding project, IGS03-05, was developed to maintain the reliability of the generators.

The original project budget included:

System studies and specification preparation	2003 - 2004	$ 85,000
Purchase and install Unit 1 excitation system	2004 - 2005	$3,760,000
Purchase and install Unit 2 excitation system and purchase spare stator winding	2005 - 2006	$7,560,000

We started reviewing the performance of the generator stator windings based, on a TIL (technical information letter) from General Electric in 1991. Early on, we determined we had a significant

problem with the hydraulic integrity of the stator windings. Global epoxy repairs of the windings in 1996 (Unit 2) and 1997 (Unit 1) significantly improved the winding integrity, but we continue to have problems passing the GE recommended vacuum and pressure tests on the stator winding.

After we started evaluating the reliability of the generators it became apparent that within a few years we would need to replace the excitation systems on both units. The current generator excitation system is no longer manufactured by General Electric (GE). GE is still providing parts, as the components are available from their suppliers, and there is limited field support personnel with Generrex experience. Recently, GE was unable to supply replacement bridge disconnect switches and field current transducers because of component obsolescence. We have had ongoing problems with drifting field current transducers, misaligned DC field circuit breakers and intermittent connections on the bridge disconnects for both units. In addition, we have had intermittent control power supply grounds on the trip circuit bus on Unit 2. We currently stock critical spare parts for most of the Generrex controls, but we do not have any spare parts for the components in the generator dome.

There are less than 30 compound source Generrex systems in service and through discussions with other Generrex owners, it is apparent that continued reliable operation of these units is not feasible. After our evaluation we decided to delay the purchase of the spare stator bars until after the Unit 2 exciter was replaced.

We have been working with GE and other vendors, since 2001, to determine the best approach for replacing our excitation system. Our system is somewhat unique because the dome, which houses the major magnetic components, is welded to the generator frame. For years, GE has recommended removing the dome so the magnetic components, located in the dome, can be removed. This process is both time consuming and risky. In April 2005, GE determined that the components in the dome could be removed by disassembling and removing them through the openings for the hydrogen coolers. Finally, in late 2005, GE agreed that there was a way to simply modify the components in the dome instead of removing them.

As part of the excitation system replacement evaluation, GE was awarded a contract to compare the electrical characteristics of a new bus fed excitation system with the current Generrex excitation system. This study was completed in June 2004 and revised in July 2004. The new bus fed system does not provide the same response as the original Generrex system. The focal point of the study was comparing critical clearing time (CCT) for faults. Both in the study and in the meeting to review the study, GE recognized there are other characteristics of excitation systems which affect system stability and reliability. Because of delays in the system studies and the development of an acceptable work scope for the dome work, the excitation replacement was delayed for one year.

A detailed specification was prepared for the new excitation systems and the work was scheduled for Unit 2 April 2006 and Unit 1 April 2007. General Electric was awarded the contract to perform this work.

The Unit 2 excitation system was replaced in March and April 2006. The new exciter and excitation transformer were installed in March 2006. During the April 2006 outage, connections to the existing controls and interfaces were completed, the dome equipment was modified and testing was completed.

The Unit 2 excitation system is now online and functioning correctly. We recently completed PSS (power system stabilizer) testing to validate the PSS settings. A report on the system is being prepared by GE for submittal to LADWP and the WECC. Over the next few months we will continue to optimize the system.

In 2005 a new concern was identified for long term reliable operation of the generators. Testing after the Unit 1 Spring 2005 outage indicated the field had developed a turn-to-turn short. This short was apparently causing thermal sensitivities in the field. The turn-to-turn short was discovered due to generator vibrations at varying field current conditions and was confirmed through flux probe testing. Plans were then made to rewind the Unit 1 field in 2007. In order to minimize impact to the capital budget, caused by the cost of rewinding the field the stator bar purchase was postponed.

In 2006, at the start of the Unit 2 outage, additional flux probe testing was performed on both units. The most recent test on Unit 1 indicates there may not be a turn-to-turn short in the field. We are currently working on a testing program to resolve the questions about the condition of the Unit 1 field. Part of the testing program included hiring an independent consultant to perform additional flux probe testing.

Depending on the results of this testing, we may delay rewinding the Unit 1 generator field. If this project is delayed, we will use the capital project funds to purchase a field re wind insulation kit and start purchasing spare stator bars.

IGS 03-05 Generator Excitation System Replacements and Spare Stator Winding

Summary

We recommend delaying the installation of the new excitation system for Unit 1 until 2007. This will allow more time to :

1. Finalize new equipment locations and finalize the routing of control cables, power cables and bus.

2. Resolve concerns on disassembling the magnetic components in the dome. We will be able to use the 2005 outage to evaluate General Electric's (GE's) recent proposal to disassemble the components in place instead of removing the generator dome.

3. Perform final electrical studies to determine critical excitation system characteristics.

4. Evaluate other utilities experience with a Generrex replacement to determine best practices and actual time requirements.

We still plan on purchasing a new excitation system in this budget but delaying the installation of the Unit 1 equipment until 2007. The Unit 2 equipment will still be installed in 2006. There is limited risk in delaying the installation of the new system for Unit 1. Both excitation systems are currently working correctly and the delivery of the new equipment will provide us with replacement components for a catastrophic failure.

Project History

The generator excitation system replacement and spare stator winding project was developed to increase the reliability of the generators. The current generator excitation system, Generrex is no longer manufactured by GE. GE is still providing parts, as the components are available from their suppliers, and there is limited field support personnel with Generrex experience. We currently stock critical spare parts for all of the Generrex controls, but we do not have any spare parts for the components in the generator dome.

Several utilities have planned for Generrex replacements in the next few years but GE has not replaced any Generrex excitation systems. GE is scheduled to replace the first system in Oct 2004 and the next system in April 2005.

We have been working with GE and other vendors, for over four years, to determine the best approach for replacing our excitation system. Our system is somewhat unique because the dome, that houses the major magnetic components, is welded to the generator frame. For years, GE has

recommended removing the dome so the magnetic components can be removed. This process is both time consuming and risky. In April 2005, GE determined that the components in the dome could be removed by disassembling and removing them through the openings for the hydrogen coolers. GE is still working out the details for this procedure and they have indicated they will provide final details with their bid. We should review their procedure, during a unit outage to verify there is adequate space within the dome to safely disassemble the components and remove them though a hydrogen cooler opening.

As part of the excitation system replacement, GE was required to provide a comparison of the electrical characteristics of a new bus fed excitation system with the current Generrex excitation system. This study was completed in June and revised in July 2004. The new bus fed system does not provide the same response as the original Generrex system. The focal point of the study was comparing critical clearing time (CCT) for faults. Both in the study and in the meeting to review the study, GE recognized there are other characteristics of excitation systems which affect system stability and reliability. We still need to continue working with the LADWP studies group to determine the most critical performance characteristics of a new excitation system.

GE has been on site three times to assist with finalizing the location of the new excitation system equipment. We are currently evaluating our third choice for the installation of this equipment. The equipment requires significant floor space and has been difficult to locate and still allow room for installation and maintenance.

The transformer, which replaces the equipment mounted in the dome, has increased in size to 11 feet by 24 feet. The size changed after GE finalized details of the transformer design with the transformer manufacturer. This requires placing the transformer on the turbine deck instead of the first floor. The location on the turbine deck will require a structural review and detailed routing of the large isolated phase bus conductors.

The original location for the excitation line up was in the same place as the existing system. This choice was abandoned early on because of outage time concerns and space requirements. The next choice was the 6900 volt switchgear room. Because the switchgear room provides a cleaner environment the design was based on a NEMA 1 enclosure. The NEMA 1 lineup requires 4 feet by 22 feet. Because of space concerns, in the switchgear room, the excitation system has been moved to the turbine deck . This has increased the size of the equipment to 8 feet by 30 feet to provide space for weather tight housing. This is a custom enclosure which GE is still finalizing with the manufacturer. This also requires significant modifications to control and power cable wiring and bus routing.

IGS 03-05 Generator Excitation System Replacements and Spare Stator Winding
Revision 2 - Sept 21, 2005

Summary

Capital Project IGS03-05 includes replacing the excitation system for both generators and purchasing one spare stator winding which can be used on either generator. The original schedule for this project is shown below:

System studies and specification preparation	2003 - 2004
Purchase and install Unit 1 excitation system	Spring 2005 Outage
Purchase and install Unit 2 excitation system	Spring 2006 Outage
Purchase of spare stator winding	June 2006

The revised schedule for generator modifications is:

System studies and specification preparation	2003 - 2005
Purchase Unit 1 and 2 excitation systems	Fall 2005
Install Unit 2 excitation system	Spring 2006 Outage
Install Unit 1 excitation system	Spring 2007 Outage
Rewind the Unit 1 Generator field	Spring 2007 Outage
Purchase of spare stator winding (multi-year)	July 2006 - June 2008

The purchase and installation of the new excitation system, for Unit 1, was delayed until the Spring 2007 Outage. This allowed more time to :

1. Finalize new equipment locations and finalize the routing of control cables, power cables and bus.

2. Resolve concerns on disassembling the magnetic components in the dome.

3. Perform final electrical studies to determine critical excitation system characteristics.

4. Evaluate other utilities experience with a Generrex replacement to determine best practices and actual time requirements.

The Unit 2 equipment will be installed in 2006 and the Unit 1 equipment in 2007. In addition, we are planning to rewind the Unit 1 Generator field in April 2007. After the Unit 1 Spring 2005 Outage, a turn-to-turn short developed in the field. Because of this short we are currently operating the generator at unity power factor to limit vibration.

The purchase of the spare stator winding has been spread over two budget cycles to equalize generator capital expenses and to allow paying for the field rewind in 2007.

Project History

The generator excitation system replacement and spare stator winding project was developed to increase the reliability of the generators. The current generator excitation system, Generrex is no longer manufactured by General Electric (GE). GE is still providing parts, as the components are available from their suppliers, and there is limited field support personnel with Generrex experience. Recently, GE has been unable to supply replacement bridge disconnect switches and field current transducers because of component obsolescence. We currently stock critical spare parts for most of the Generrex controls, but we do not have any spare parts for the components in the generator dome.

The original project budget included:

System studies and specification preparation	2003 - 2004	$ 85,000
Purchase and install Unit 1 excitation system	2004 - 2005	$3,760,000
Purchase and install Unit 2 excitation system and purchase spare stator winding	2005 - 2006	$7,560,000

Several utilities have planned for Generrex replacements in the next few years but until recently none of the systems had been replaced. GE replaced the first Generrex excitation system in the Fall of 2004 at the Coronado Generating Station. Alstom is scheduled to replace their first Generrex system in May 2005. GE has two more replacements scheduled in late 2005 and early 2006.

We have been working with GE and other vendors, since 2001, to determine the best approach for replacing our excitation system. Our system is somewhat unique because the dome, that houses the major magnetic components, is welded to the generator frame. For years, GE has recommended removing the dome so the magnetic components can be removed. This process is both time consuming and risky. In April 2005, GE determined that the components in the dome could be removed by disassembling and removing them through the openings for the hydrogen coolers. GE is still working out the details for this procedure and they have indicated they will provide final details with their bid. We should review their procedure, during a unit outage to verify there is adequate space within the dome to safely disassemble the components and remove them though a hydrogen cooler opening.

As part of the excitation system replacement, GE was required to provide a comparison of the electrical characteristics of a new bus fed excitation system with the current Generrex excitation system. This study was completed in June and revised in July 2004. The new bus fed system

does not provide the same response as the original Generrex system. The focal point of the study was comparing critical clearing time (CCT) for faults. Both in the study and in the meeting to review the study, GE recognized there are other characteristics of excitation systems which affect system stability and reliability. We still need to continue working with the LADWP studies group to determine the most critical performance characteristics of a new excitation system.

GE has been on site three times to assist with finalizing the location of the new excitation system equipment. We are currently evaluating our third choice for the installation of this equipment. The equipment requires significant floor space and has been difficult to locate and still allow room for installation and maintenance.

The transformer, which replaces the equipment mounted in the dome, has increased in size to 11 feet by 24 feet. The size changed after GE finalized details of the transformer design with the transformer manufacturer. This requires placing the transformer on the turbine deck instead of the first floor. The location on the turbine deck will require a structural review and detailed routing of the large isolated phase bus conductors.

The original location for the excitation line up was in the same place as the existing system. This choice was abandoned early on because of outage time concerns and space requirements. The next choice was the 6900 volt switchgear room. Because the switchgear room provides a cleaner environment the design was based on a NEMA 1 enclosure. The NEMA 1 lineup requires 4 feet by 22 feet. Because of space concerns, in the switchgear room, the excitation system has been moved to the turbine deck . This has increased the size of the equipment to 8 feet by 30 feet to provide space for weather tight housing. This is a custom enclosure which GE is still finalizing with the manufacturer. This also requires significant modifications to control and power cable wiring and bus routing.